

Short Account of the Anatomy of a Nudibranchiate Mollusk, *Aeolidiella takanosimensis* Baba, 1930 from Japan

(Eolidioidea : Aeolidiidae)

BY

KIKUTARÔ BABA

Shigigaoka 35, Minami-11-jyo, Sango-cho, Ikoma-gun, Nara-ken, Japan

(6 Text figures)

THE SPECIES, *Aeolidiella takanosimensis*, was established by BABA, 1930, on the specimens collected from Tateyama Bay, Boshu ($34^{\circ}59'N$; $139^{\circ}50'E$). It was then presumed to be referable to *Eolis* sp. of IJIMA, 1918 shown in his book by an outline of the animal. Fortunately, *A. takanosimensis* was rediscovered by different authors (BABA, 1949; BABA & HAMATANI, 1952; ABE, 1964; INABA, 1963; USUKI, 1969; etc.) from a number of stations situated on the east and west coasts of the lower half of Japan, the southernmost limit of location being Tomioka of Amakusa ($32^{\circ}31'N$; $130^{\circ}02'E$). Moreover, there occurred latest records of this species in the Mediterranean Sea (SCHMEKEL, 1968; 1970) and the west coast of North America (San Diego and Los Angeles counties by SPHON, 1971; and Baja California del Sur by FERREIRA & BERTSCH, 1975).

Here *Aeolidiella takanosimensis* is separated from *A. multicolor* Macnae, 1954 from False Bay, South Africa by the slight difference visible in the composition of the first several branches of the left posterior liver on the right side (see also MARCUS & MARCUS, 1967: 117).

The present study concerns the general morphology of *Aeolidiella takanosimensis* explored at different stations in Japan. However, I was indebted to Mr. Iwao Hamatani of the Tennoji Senior High School, Osaka Kyoiku University, for dissecting the liver system of the animal for illustration. My thanks are also due to those persons who helped me in collecting part of the specimens from shores.

Aeolidiella takanosimensis Baba, 1930

(Japanese name: Mino-umiushi)

(Figures 1-6)

Main Synonymy:

Aeolidiella takanosimensis BABA, 1930: 122, 124; pl. 4, figs. 5a-5c; text figs. 4a-4b. - Takanoshima, Tateyama Bay. BABA, 1949: 111-112, 183-184; pl. 49, fig. 167; text figs. 154-155. - Sagami Bay. ABE, 1964: 72-73; pl. 36, fig. 129. - Sado Island, Toyama Bay and vicinity. SCHMEKEL, 1970: 155-156. - Naples (genitalia). FERREIRA & BERTSCH, 1975: 329, fig. 19. - Baja California del Sur.
Eolidina (Eolidina) takanosimensis. BABA, 1937: 336 (generic name change).

Localities in Japan: Tateyama Bay; Tokyo Bay; Sagami Bay; Sugashima, Shima; Seto, Kii; Osaka Bay; The Inland Sea of Seto; Saeki Bay; Amakusa; Fukaura; Sado Island; Toyama Bay and vicinity

Distribution in the World: The Mediterranean Sea; East Pacific Ocean.

Main Material Examined:

Specimen no. 1: Sugashima, Shima, 9 April 1951
Specimen no. 2: Seto, Kii, 12 January 1971

- Specimen no. 3: Ohkawa, Osaka Bay, 20 August 1959
(dissected by Hamatani for the liver system)
- Specimen no. 4: Tomogashima, Osaka Bay, 6 May 1962 (prepared in horizontal serial sections)
- Specimen no. 5: Mukaishima, the Inland Sea of Seto, 29 March 1964
- Specimen no. 6: Ohnyu-jima, Saeki Bay, 2 and 4 April 1957
- Specimen no. 7: Tomioka, Amakusa, 21 May 1974
- Specimen no. 8: Ogi, Toyama Bay, 6 August 1960 (prepared in horizontal serial sections)
- Specimen no. 9: Ojima near Tojinbo, Echizen Coast, 12 August 1977

Description:

External Form: The animals collected for this study are generally small, and range from 6 to 13 mm in total length (the type specimens of *Aeolidiella takanosimensis* were 17 to 30 mm long while the 2 specimens recorded by Ferreira & Bertsch from Baja California del Sur measured 40 mm in length). The rhinophores are always smooth; they do not bear perfoliations that were noted on the preserved specimens of *Aeolidiella* (? *takanosimensis*) of RISBEC, 1956: 31-32 from Viet Nam. This latter form was renamed *Spurilla risbeci* by MARCUS, 1961: 56. The foot corners are angulated. The tail is moderately extended behind.

In Specimen no. 3 there are 23 to 25 rows of papillae on the back margins, of which the anteriormost 6 to 7 rows are to be attributed to the right liver (and the left partner), and the rest to the left posterior liver. The papillar arrangement after EDMUNDS, 1970 is as follows (Hamatani's observation): 5, 7, 8, 7, 8, 8, 2; 4, 5, 5, 3; 5, 5, 2, 2; 4, 1, 2; 4, 3; 3, 2, 2, 1, 1 on the right side, and 2, 3, 6, 6, 5, 7; 6, 5, 5, 4; 3, 4, 5; 2, 3; 2, 3; 2, 2, 1, 1, 1 on the left side. The cleioproct anus opens on the right side within the first group of rows belonging to the left posterior liver. However, the anus tends to be pleuroproct in situation as observed in Specimens nos. 2, 6 and 8, separately. A pleuroproct position of the anus is also recorded from a paratype of *Cerberilla albopunctata* BABA, 1976: 276. The nephroproct lies closely in front of the anus. The genital orifices are found under anterior rows of the right liver rows. The branchial papillae themselves are contractile, and long or short fusiform according to their state of movement. They are not flattened.

In *Aeolidiella takanosimensis* the first rows of the branchial papillae on each side of the body do not appear to form a cephalic crown ("collerette céphalique") that was called attention to by TARDY, 1969 from some Atlantic

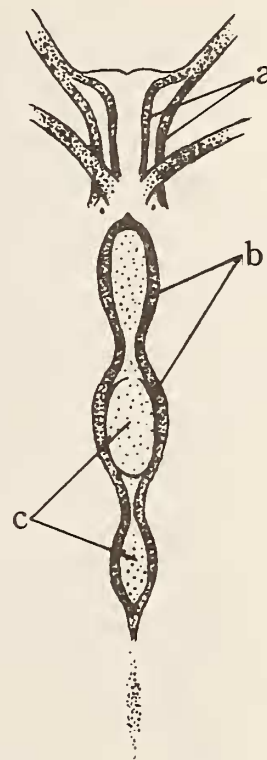


Figure 1

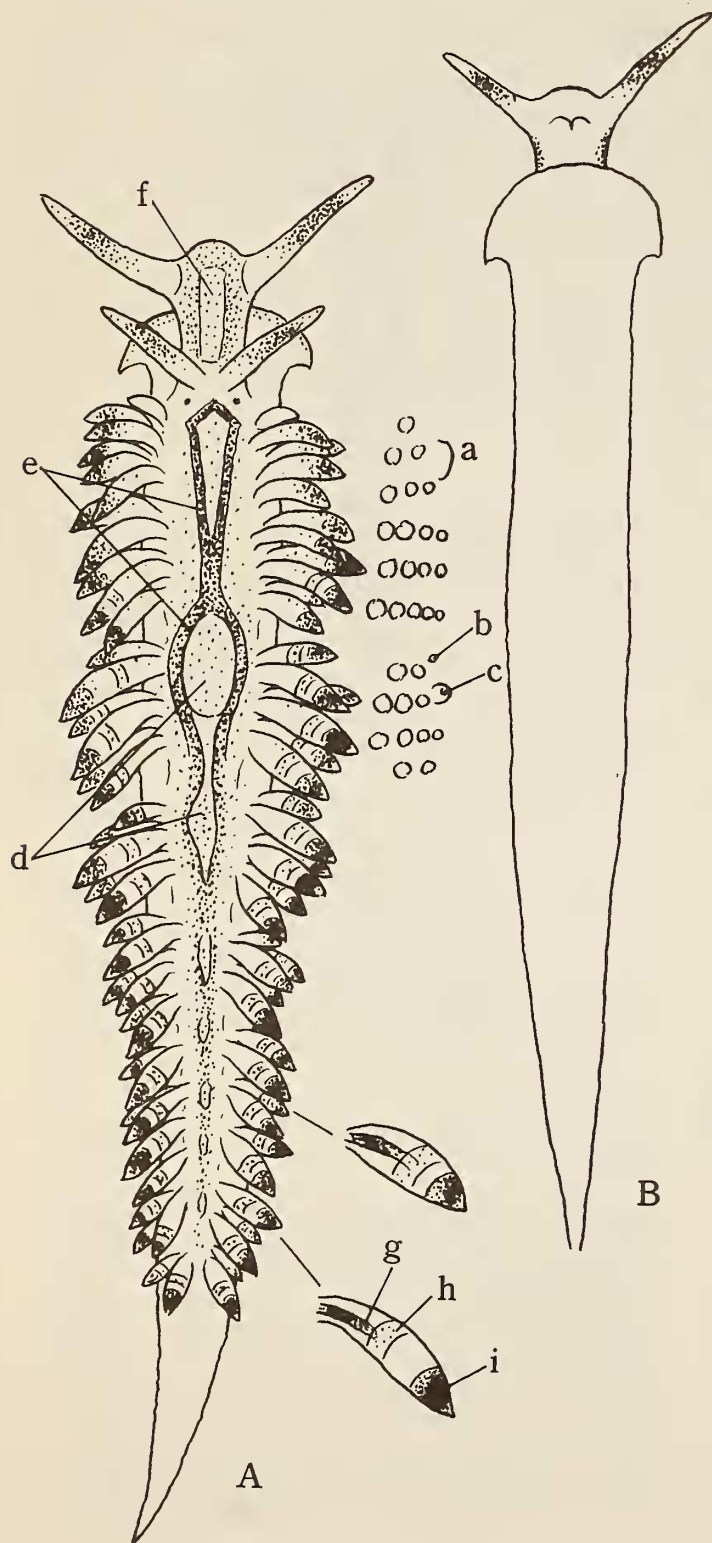
Aeolidiella takanosimensis Baba, 1930

Specimen no. 6, length 15 mm

Normal patterns of vermilion on the head (a) and back (b), and opaque white patches (c) in the median dorsal line

species of *Aeolidiella* (i.e., *A. glauca*, *A. alderi* and *A. sanguinea*).

Coloration: *Aeolidiella takanosimensis* is especially characterized by the possession of vermilion-tinted figures on the head and back. The formation of these figures, however, differs according to specimens. Usually there is a U-shaped letter (or a U-letter broken below) of vermilion on the head in the median line. The sides of the head are vermilion. The pericardial region is surrounded by a vermilion-tinted, oval or rhomboidal figure, the 2 horns of which extend forward to the bases of the rhinophores and often are united transversely. This vermilion figure passes back in the median line for some distance, too. The region



defined by the vermilion figure is dotted with opaque white. The oral tentacles and the rhinophores are opaque white above, and vermilion below. The branchial papillae are as a rule banded with opaque white below the vermilion cap. The liver diverticulum within the respective papillae is dark brown. The general integument of the body including the sole is colorless.

Variation of color patterns is not rare. In the Specimen no. 7 there is a row of vermilion figures in the mid-dorsal line between the rhinophores and the tail. Specimen no. 2, which is uniformly vermilion-tinted on the head, is entirely free from those vermilion figures which occur dorsally in the normal specimens.

Here should be mentioned that *Aeolidiella multicolor* Macnae, 1954 from False Bay, South Africa is closely related to *A. takanosimensis* in the ornate colors of the body, but the 2 are different slightly from each other in the composition of the first several branches of the left posterior liver on the right side (see also MARCUS & MARCUS, 1967: 117).

Internal Anatomy: The jaws and radula are characterized fundamentally as usual in the genus *Aeolidiella*. That is, the jaw-edge is smooth, and the teeth of the radula are arcuated with a median emargination. The radular formulae examined are from $12 \times 0.1.0$ to $20 \times 0.1.0$. Each tooth is provided with 15 to 20 pectinate denticles on either side of the median cusp. It appears a little strange that the figured tooth of *Aeolidiella takanosimensis* from Baja California del Sur (FERREIRA & BERTSCH, 1975: 329; fig. 19) is low and somewhat more widened than that discussed in this paper.

The branches of the liver system are defined to correspond to the rows of papillae on back margins. Then there are many (6 to 7 in Specimen no. 3) branches in the right liver (and the left partner). The first several (4 in Specimen no. 3) branches of the left posterior liver on the

(← adjacent column)

Figure 2

Aeolidiella takanosimensis Baba, 1930

Specimen no. 9, length 13 mm

Living animal from dorsal (A) and ventral (B) sides

a - genital orifices b - nephroproct c - anus

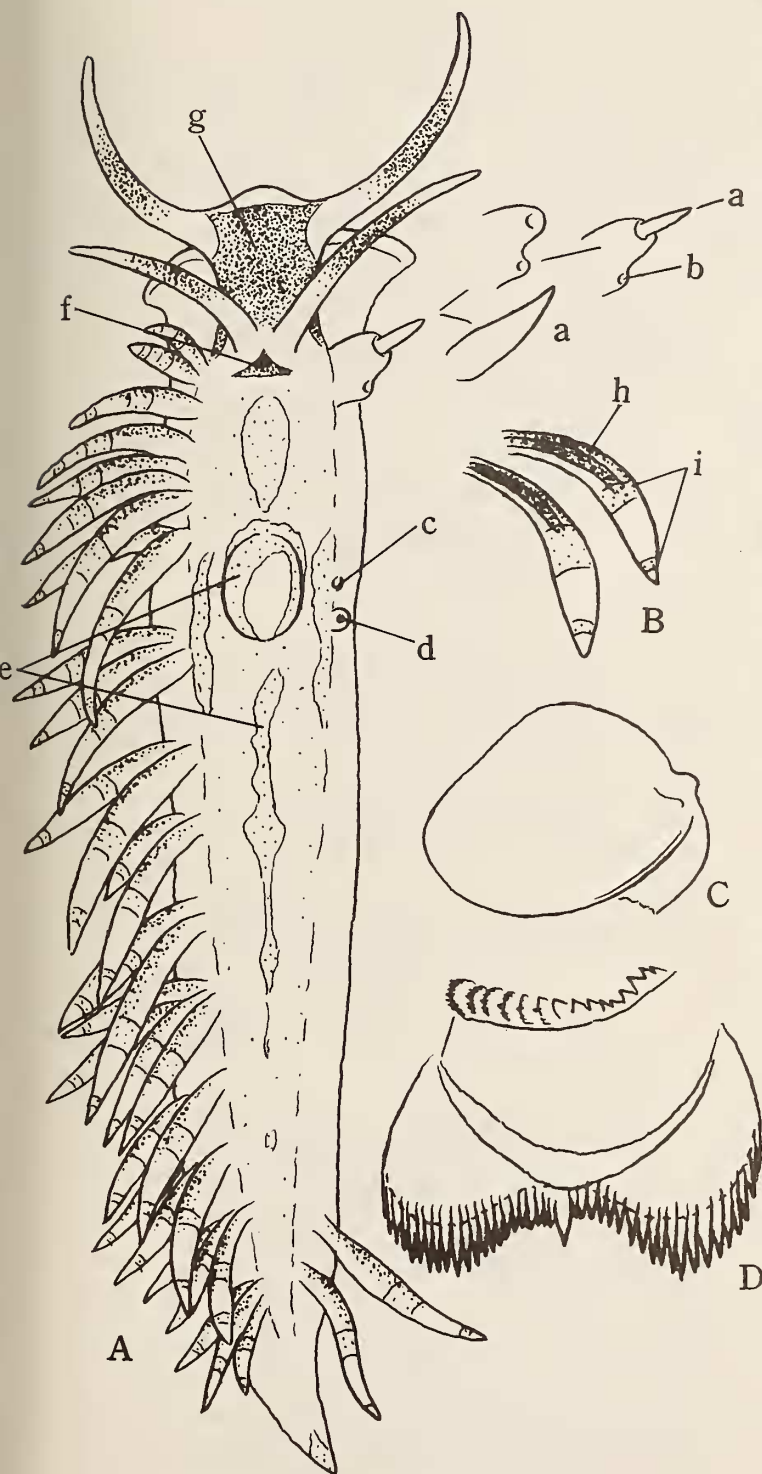
d - opaque white patches in the median dorsal line

e - vermilion-tinted figure in the back

f - opaque white patch on the head

g - dark brown liver diverticulum h - opaque white band

i - vermilion cap



right side are collected into a group within which is found a cleioproct anus (the anus is sometimes pleuroproct as described previously). In *Aeolidiella multicolor* the first several branches (in the present author's opinion) of the left posterior liver on the right side tend to form arches, and the anus opens behind the first one of these arches (see also MARCUS & MARCUS, 1967: 117).

The mouth part has 2 pairs of accessory glands: (1) The salivary glands are narrow band-like as usual. (2) The oral glands are each in the form of an elongated sac which debouches into the oral tube at about the opening of the pharynx. The duct of the sac is short, and the wall of the sac itself is accompanied by gigantic cells.

The genital complex could not be analyzed thoroughly. The penis is muscular, conical, and unarmed (see also SCHMEKEL, 1970: 155; fig. 16b). The vas deferens is prostatic throughout the length. A single spermatocyst is present.

Remarks: The genus *Aeolidiella* Bergh, 1867, together with the type species, *Eolida soemmerringii* Leuckart, 1828 (see SUTER, 1913: 581; LEMCHE, 1964: 118, 119) does not appear to be satisfactorily defined from the standpoint of taxonomy. Moreover, the morphology of *Eolida soemmerringii* remains mostly obscure (see TARDY, 1969: 34-35). But according to the suggestion by MACNAE, 1954: 36, the members of *Aeolidiella* may conveniently be divided into 2 groups (see also BURN, 1962: 126):

Group I: Species with the right liver many-branched.

Group II: Species with the right liver in the form of an arch.

At present it seems reasonable to classify *takanosimensis* Baba, 1930 within Group I of the genus *Aeolidiella* in the usual sense.

The following species from Japan are then referable to Group II:

(← adjacent column)

Figure 3

Aeolidiella takanosimensis Baba, 1930

Specimen no. 2, length 10 mm

A presumed variant in the coloration of the body

- A: living animal from dorsal side B: branchial papillae
 C: right jaw ($\times 30$) D: tooth ($\times 240$)
 a - protruded penis b - female orifice c - nephroproct
 d - anus e - opaque white patches in the median dorsal line
 f - vermillion bar behind the rhinophores
 g - vermillion tinge on the head
 h - vermillion tinge on the papillae i - opaque white bands

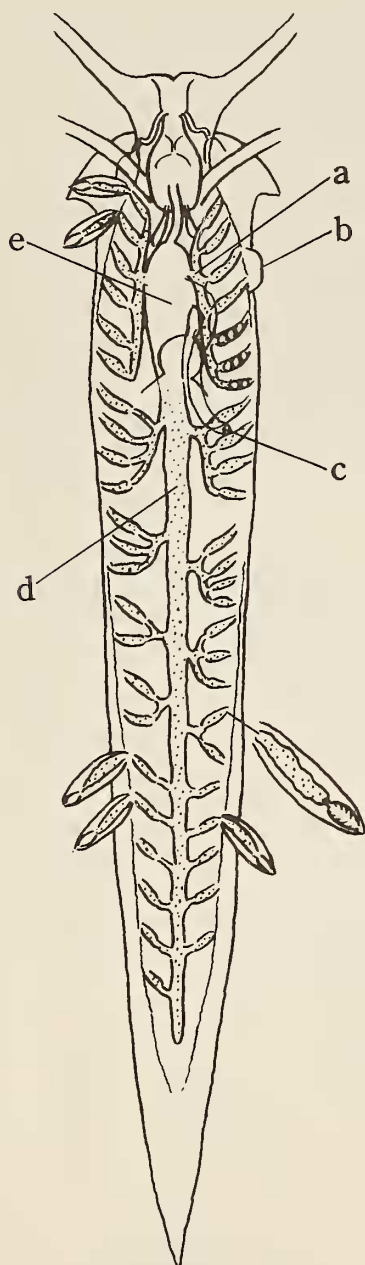


Figure 4

Aeolidiella takanosimensis Baba, 1930

Specimen no. 3, length 12 mm

Digestive system [mainly dissected by I. Hamatani]

a - right liver b - genital orifices c - anus
d - left posterior liver e - stomach

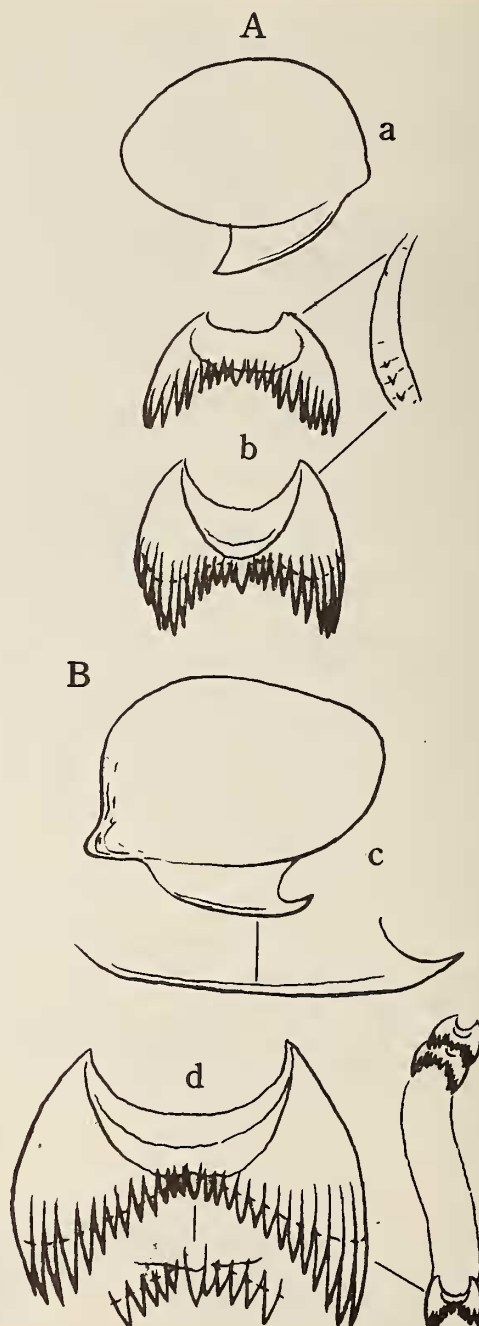


Figure 5

Aeolidiella takanosimensis Baba, 1930

A: Specimen no. 1, length 10 mm

a - right jaw ($\times 20$) b - teeth ($\times 110$)

B: Specimen no. 5, length 9 mm

c - left jaw ($\times 30$) d - tooth ($\times 150$)

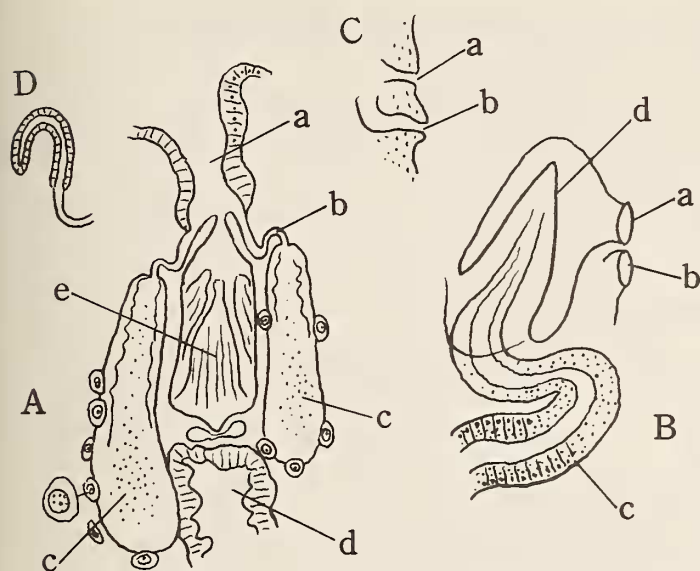


Figure 6

Aeolidiella takanosimensis Baba, 1930

A: Specimen no. 4, length 10 mm

Anterior part of the digestive system from dorsal side ($\times 30$)a - oral tube b - duct of the oral gland (c) d - stomach
e - pharynx

B: The same specimen

Anterior part of the reproductive system from dorsal side ($\times 80$)a - male orifice b - female orifice
c - prostatic vas deferens d - penis

C: Specimen no. 8, length 10 mm

Nephroproct (a) and anus (b) as seen from a horizontal section ($\times 20$)

D: The same specimen

Salivary gland ($\times 20$)

1. *Aeolidiella japonica* Eliot, 1913
(Japanese name: Yamato-minoumiushi)
2. *Aeolidiella alba* Risbec, 1928
(Japanese name: Shiro-minoumiushi, new name; new record for Japan)

In these 2 species the anus is found far behind the first right arch of the left posterior liver (see also TARDY, 1969: 19; plt. 9). In the genera *Berghia* Trinchese, 1877 and *Spurilla* Bergh, 1864 the right liver is arched, and the anus lies within the first arch of the left posterior liver on the right side. *Berghia* is separated from *Spurilla* merely by having granulated rhinophores and produced foot corners (in *Spurilla* the rhinophores are perfoliated and the

foot corners are rounded). Two species of *Berghia* were previously recorded from Japan:

1. *Berghia japonica* (Baba, 1933)
= *Baeolidia japonica* Baba, 1933
(Japanese name: Yamato-wagushi-minoumiushi)
2. *Berghia major* (Eliot, 1903)
= *Baeolidia major amakusana* Baba, 1937
(Japanese name: Wagushi-minoumiushi)

SUMMARY

1. *Aeolidiella takanosimensis* Baba, 1930 is redescribed on the basis of specimens collected from various stations of southern Japan.
2. This species is easily recognizable by the possession of vermilion-tinted figures on the head and back, and examples of individual variation of these figures are considered.
3. In order to find proper characters of the species other than the body colors, jaws and radular teeth, some information in connection with the liver system and part of the genital system is given based on sections of the animal.
4. A brief mention is made of the taxonomic separation of *Aeolidiella* from the two allied genera, *Berghia* and *Spurilla*.

POSTSCRIPT

It was noticed that *Shinanoelolis* Baba, 1965 [type: *Cuthona* (*Hervia*) *emurai* Baba, 1937; Japanese name, Emura-minoumiushi] was synonymous with *Hermisenda* Bergh, 1878; furthermore, the species *emurai* was to be reidentified as *Hermisenda crassicornis* (Eschscholtz, 1831) from Alaska, Pacific North America and Mexico. According to MILLER, 1974, however, *Hermisenda* was referable to *Phidiana* Gray, 1850 (*s. l.*) (subfamily Facelininae in the meaning of MILLER, 1974).

Literature Cited

- ABE, TAKEO
1964. Opisthobranchia of Toyama Bay and adjacent waters. Hokuryu-Kan, Tokyo. 9+99 pp.; 36 pls.; 43 text figs. (March 1964)
- BABA, KIKUTARŌ
1930. Studies on Japanese nudibranchs. 3. The Venus 2 (3): 117-125; plt. 4; 5 text figs. (10 December 1930)
1937. Opisthobranchia of Japan (II). Journ. Dept. Agric. Kyushu Imp. Univ. 5 (7): 289-344; pls. 1-2; 18 text figs. (20 Nov. 1937)
1949. Opisthobranchia of Sagami Bay, collected by his Majesty the Emperor of Japan. Iwanami Shoten, Tokyo. 4+2+194+7 pp.; 50 pls.; 161 text figs. (September 1949)

- BABA, KIKUTARÔ
1976. The genus *Cerberilla* of Japan (Nudibranchia: Eolidioidea: Aeolidiidae), with the description of a new species. *The Veliger* 18 (3): 272-280; 1 plt.; 10 text figs. (1 January 1976)
- BABA, KIKUTARÔ & IWAO HAMATANI
1952. List of the species of the Opisthobranchia from Kii, Middle-Japan. *Nanki-Seibutsu Suppl.* 1: 1-11 (20 April 1952)
- BURN, ROBERT
1962. Descriptions of Victorian nudibranchiate Mollusca, with a comprehensive review of the Eolidacea. *Mem. Nat. Mus. Melb.* 25: 95-128; 26 text figs. (1 May 1962)
- EDMUNDS, MALCOLM
1970. Opisthobranchiate Mollusca from Tanzania. II. Eolidacea (Cuthonidae, Piseinotecidae and Facelinidae). *Proc. Malac. Soc. London* 39 (1): 15-57; figs. 1-24 (April 1970)
- FERREIRA, ANTONIO J. & HANS BERTSCH
1975. Anatomical and distributional observations of some opisthobranchs from the Panamic faunal province. *The Veliger* 17 (4): 323-330; 3 pls.; 1 text fig. (1 April 1975)
- IJIMA, ISAO
1918. A manual of zoology. *Dai Nippon Tosho K. K. Ed.* 1, 1918; Ed. 14, 1925. 950+30 pp.; 1014 text figs.
- INABA, AKIHIKO
1963. Fauna and flora of the Island Sea of Seto. Mukaishima Marine Biological Station. Jubilee number for the thirtieth anniversary of the foundation of the Station. 352 pp.; 1 map; 6 pls. (20 Oct. 1963)
- KOMORI, SEICHI
1932. Origin of the eolidian nematocysts from the standpoint of regeneration. *Annot. Zool. Japon.* 13 (4): 391-397; 4 text figs. (5 May 1932)
- LEMICHE, HENNING
1964. *Aeolidiella* Bergh, 1867, and *Calma* Alder & Hancock, 1855 (Gastropoda): Two generic names proposed for protection under the plenary powers. *Z. N. (S.)* 1098. *Bull. zool. Nomencl.* 21 (2): 118-119 (April 1964)
- MACNAE, WILLIAM
1954. On some eolidacean nudibranchiate molluscs from South Africa. *Ann. Natal Mus.* 13 (1): 1-50; pls. 1-2; 32 text figs. (June 1954)
- MARCUS, ERNST
1961. Opisthobranch mollusks from California. *The Veliger* 3 (Supplement, part 1): 1-85; pls. 1-10 (1 February 1961)
- MARCUS, EVELINE DU BOIS-REYMOND & ERNST MARCUS
1967. American opisthobranch mollusks. *Stud. trop. Oceanogr.* Miami 6: 8+256 pp.; 1 plt.; 250 text figs. (December 1967)
- MCDONALD, GARY R. & JAMES WILLARD NYBAKKEN
1978. Additional notes on the food of some California nudibranchs with a summary of known food habits of California species. *The Veliger* 21 (1): 110-119 (1 July 1978)
- MILLER, MICHAEL CHARLES
1974. Aeolid nudibranchs (Gastropoda: Opisthobranchia) of the family Glaucidae from New Zealand waters. *Zool. Journ. Linn. Soc.* 54 (1): 31-61; 1 plt.; 10 text figs. (January 1974)
- OKAWA, KEIKO
1974. On the cleptocnidae of an eolid. *Zool. Mag.* 83 (4): 305 (December 1974)
- RISBEC, JEAN
1956. Nudibranches du Viet-Nam. *Arch. Mus. Nat. Hist. Nat. Paris* 7 (4): 1-34; 22 pls.
- SALVINI-PLAWEN, LUITFRIED V.
1972. Cnidaria as food sources for marine invertebrates. *Cah. Biol. Mar.* 13 (3): 385-400; 1 plt.
- SCHMEKEL, RENATE LUISE
1968. Ascoglossa, Notaspidea und Nudibranchia im Litoral des Golfes von Neapel. *Rev. Suisse Zool.* 75 (6): 103-155; 21 text figs. (March 1968)
1970. Anatomie der Genitalorgane von Nudibranchiern (Gastropoda Euthyneuren). *Pubbl. Staz. Zool. Napoli* 38 (1): 120-217; 67 figs.
1971. Histologie und Feinstruktur der Genitalorgane von Nudibranchiern (Gastropoda, Euthyneura). *Zeitschr. Morph. Tiere* 69: 115-183; figs. 1-31
- SPHON, GALE G.
1971. New opisthobranch records for the eastern Pacific. *The Veliger* 13 (4): 368-369 (1 April 1971)
- SUTER, HENRY
1913. Manual of the New Zealand Mollusca with the atlas of quarto plates. Wellington, N. Z. 23+1120 pp.; 72 pls.
- TAKAOKA BIOLOGICAL CLUB
1978. Distributional list of the Opisthobranchia in the central Japan Sea province. 146 pp.; 1+10 pls.; 170 maps (25 Jan. 1978)
- TARDY, JEAN
1969. Étude systématique et biologique sur trois espèces d'Aeolidiellés des côtes européennes (Gastéropodes Nudibranches). *Bull. Inst. Océanogr. Monaco* 68 (1389): 1-40; pls. 1-15
- USUKI, ITARU
1969. Opisthobranch fauna in the Sado districts of the Japan Sea. *Sado Hakubutsu-kan Kanpo* 18: 3-14; pls. 1-3

